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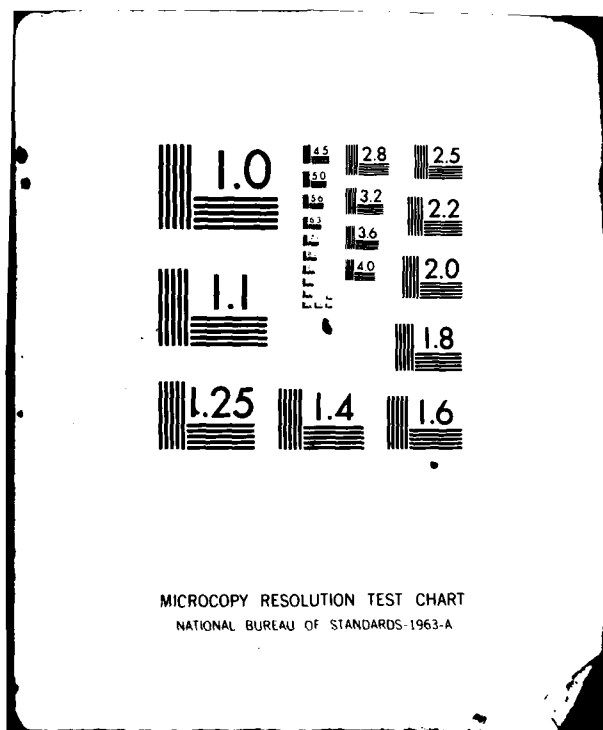
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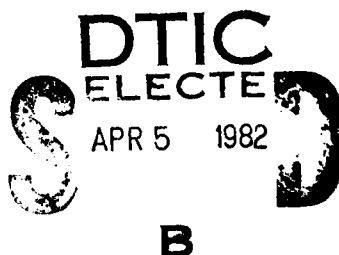
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Bibliography of in-house  
and contract reports,  
supplement 10

Rosalinda P. Barrón

Margaret F. Fox

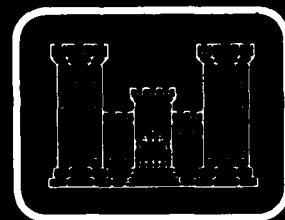
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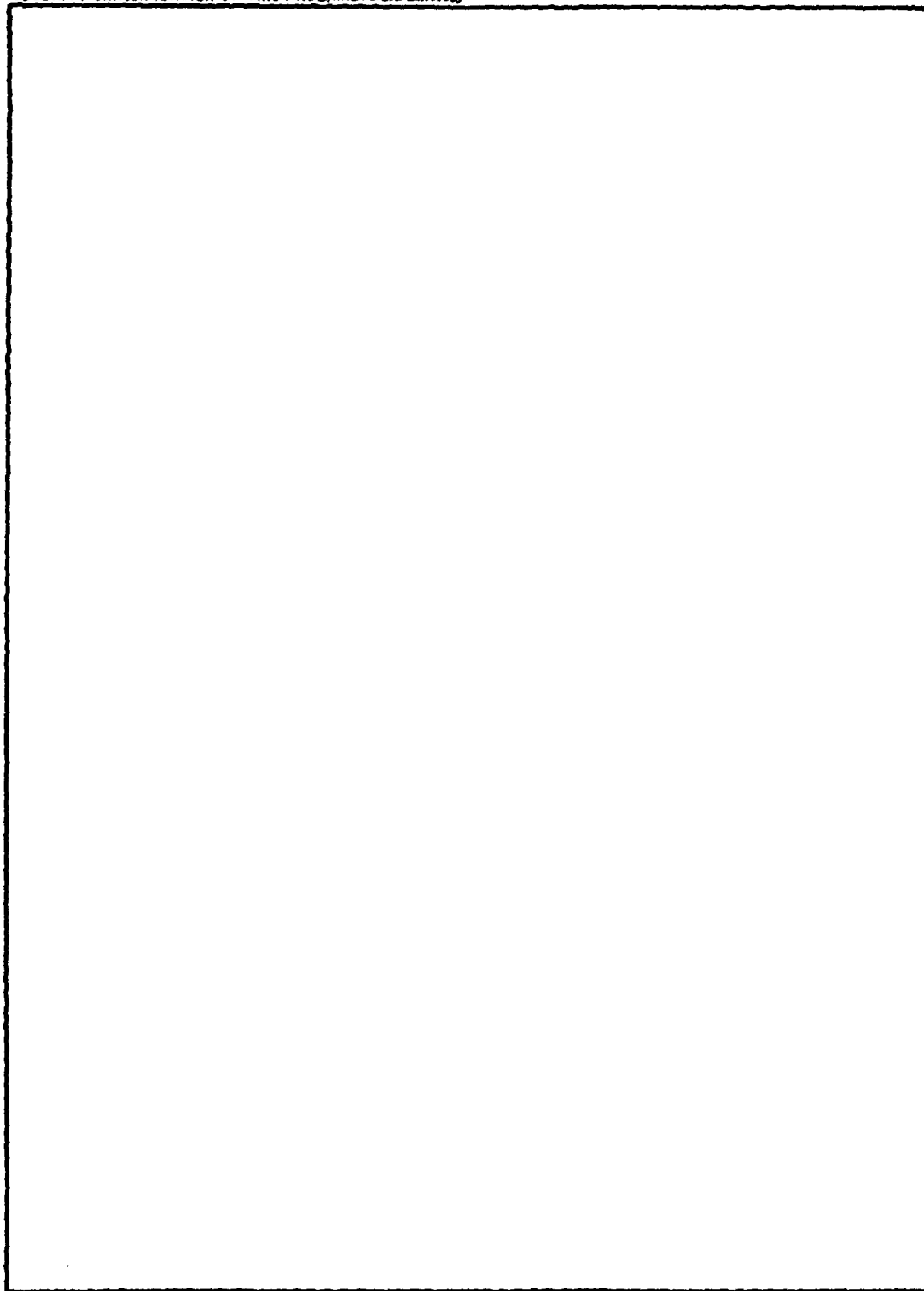
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## PREFACE

This is Supplement 10 to the report titled "Bibliography of In-House and Contract Reports" (AD-877 653L), (Supplement 1, AD-890 066L), (Supplement 2, AD-905 548L), (Supplement 3, AD-B005 275L), (Supplement 4, AD-B010 6421), (Supplement 5, AD-B019 966L), (Supplement 6, AD-A055 468), (Supplement 7, AD-A068 744), (Supplement 8 AD-A084 111), (Supplement 9, AD-A099 803). It is a continuing bibliography of reports prepared by and for the U.S. Army Engineer Topographic Laboratories (USAETL), Fort Belvoir, VA. This bibliography includes reports that were published from 1 January 1981 through 31 December 1981.

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COL Edward K. Wintz, CE was Commander and Director, and Mr. Robert P. Macchia was Technical Director of the Engineer Topographic Laboratories during the report preparation.

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ETL-0212

AD-A110 795

Leighty, Robert D.

**OPTICAL POWER SPECTRAL ANALYSIS  
FOR MACHINE-READABLE FACTOR MAPS  
December 1980**

**Keywords:** Computer Simulation, Diffraction Pattern Sampling, Graphics Data Base, Map Storage and Retrieval, Terrain Information Systems.

A preliminary investigation of the application of Optical Power Spectral Analysis (OPSA) approaches to machine-readable factor maps for terrain information systems is presented. The objective is to offer a more compact, simpler, and cheaper data base storage and retrieval system that would be available by all digital technology. In the basic concept of the systems, OPSA is used to decode data from reduced factor maps that have been encoded by spatial frequency and direction of optical gratings.

ETL-0240

AD-A100 034

Stockman, George C.

Smith, Russell C.

Chang, I-Lok.

**THE DESIGN AND ANALYSIS OF A  
HIGH-PRODUCTION MINI-COMPUTER SYSTEM FOR  
REGRIDDING DIGITAL TERRAIN ELEVATION MATRICES  
October 1980**

L.N.K. Corporation

DAAK70-80-C-0022

**Keywords:** Digital Terrain Elevation Matrices, Transformation, Regridding.

This report studies a new algorithm for the regridding and transformation of Digital Terrain Elevation Matrices. The new algorithm uses sequential accesses to mass storage devices rather than the random methods used by the software system currently installed at the Defense Mapping Agency. Due to the simplicity of the new algorithm, minicomputers can be used in place of a large mainframe computer. Four potential minicomputer systems are examined. Benchmark test results are given which show the feasibility of minicomputer use. Recommendations are made concerning the minicomputer to select if the new algorithm is to be implemented.

ETL-0241

AD-A101 321

Heydt, Howard L.  
Wescott, Thomas F.  
Peterson, Christopher J.

**INTERACTIVE DIGITAL IMAGE PROCESSING  
FOR TERRAIN DATA EXTRACTION**

November 1980

General Electric Company

DAAK70-79-C-0153

**Keywords:** Digital Image, Image Processing, Information Extraction, Interactive Analysis, Terrain Analysis, Vegetation Element Extraction.

A 12-month experimental study has been performed to investigate man-machine interactive digital image processing techniques applied to the extraction of terrain analysis data from aerial imagery. The study focuses primarily on the extraction of vegetation data elements from digitized panchromatic photography, with a small amount of attention given to thermal infrared and side-looking radar imagery. Of thirteen vegetation data elements listed in the USAETL Terrain Analysis Procedural Guide for Vegetation, eight are addressed in varying degrees of depth in the study. Interactive digital techniques are developed for vegetation/land cover boundary extraction, and for the extraction of several forest related data elements such as percent canopy closure, number of stems per hectare, tree crown diameter, number of trees per hectare in each stem diameter class, and others. The extraction techniques are developed using an existing general-purpose, interactive digital image analysis system - the General Electric DIAL (Digital Image Analysis Laboratory). Results are compared in two cases to those achieved via existing manual analysis procedures. While the interactive digital extraction techniques exhibit a promising potential, some technical problems remain. Further development, testing and evaluation are warranted using greater variety of test imagery, including radar and thermal imagery.

ETL-0242

AD-B058 420L

Green, L. Dale

**FEASIBILITY STUDY OF A QUICK  
RESPONSE MULTICOLOR PRINTER (QRMP)**  
September 1980

Xerox Electro-Optical Systems

DAAK70-78-C-0135

**Keywords:** Color Image Processing, Color Xerography, Laser Reprography, Laser Scanning Xerography, Map Printer, Quick-Response Color Reproduction.

The feasibility of a quick response multicolor printer for reproducing maps and similar items in U.S. Army field operations was studied. The system is based on the use of color xerography and laser scanning, which, in combination, appeared well-suited to the fast response, low volume, moderate throughput objectives and to the mobile van deployment needs underlying this project. Because of the requirement for high image quality, precise color-to-color register, and a 24 by 30 inch sheet format, register and sheet handling in the xerographic subsystem were determined to be the principal technical issues to be resolved. The xerographic developer and optical subsystems were also considered significant as feasibility questions. Analytical and experimental investigations in these areas led to the conclusion that a feasible system using available technologies can be developed to satisfy the stated performance goals. The report provides technical data resulting from these investigations as well as descriptions of system architecture and design concepts envisaged for a map printer meeting the objectives of the program.

ETL-0243

AD-A091 928

Lott, R. W.  
Stadelman, S. G.  
Faiss, R. O.

**STARAN IMAGE PROCESSING**  
October 1980

Goodyear Aerospace Corporation

DAAK70-79-C-0221

**Keywords:** Edge Enhancement, Parallel Processing, Relaxation Labeling.

This report discusses an image edge pixel enhancement technique that has been implemented on the joint CDC-6400 STARAN computer facility at ETL. The algorithm employs the interactive processes typical of relaxation labeling.

ETL-0246

AD-A101 350

Grosso, P.F.  
Tarnowski, A.A.

**PRE-PRODUCTION MODEL CARTOGRAPHIC  
EBR SYSTEM**  
November 1980

Image Graphics, Inc.

DAAK70-78-C-0188

**Keywords:** Automated Cartography, Cartographic EBR, Computer Output Graphics, Electron Beam Recorder (EBR), Raster Scan Translator, Symbol/Vector Generator.

The pre-production Model Cartographic EBR System installed at the Hydrographic/Topographic Center in Washington, D.C. is a high speed, high resolution, recording system capable of plotting both lineal and raster data developed for the Defense Mapping Agency (DMA) to produce color separation film masters for maps, charts and high resolution satellite and aerial imagery from digital cartographic and image data on magnetic tape. The color separations are used to prepare press-ready printing plates for conventional multi-color printing presses for the printing of color charts and maps or to produce color composites of satellite imagery.

ETL-0248

AD-A102 619

Lambird, Barbara A.  
Lavine, David  
Stockman, George C.  
Hayes, Kenneth C.  
Kanal, Laveen N.

**STUDY OF DIGITAL MATCHING  
OF DISSIMILAR IMAGES**  
November 1980

L.N.K. Corporation

DAAK70-79-C-0234

**Keywords:** Automated Cartography, Correlation, Dissimilar Images, Feature Extraction, Image Analysis, Image Matching, Pattern Recognition, Registration.

In this report, the registration of digital images from similar and dissimilar sensors is studied. The matching problem is divided into four subproblems: 1. detecting and extracting appropriate features; 2. determining an approximate global registration; 3. determining disparity for a subset of points in the image; and 4. determining the global nonlinear transformation for the entire image.

Three classes of features and their detectors are considered; edge features, point features, and region features. Several registration methods are described, including a number of correlation procedures, the L.N.K. registration technique and its 3-d extension, and some region matching procedures. The registration techniques are briefly compared and contrasted. Their ability to handle the full rotation, scale and translation transformations, and their time and space requirements are considered. It is concluded that only two registration techniques are worthy of further investigation: the L.N.K. registration technique and a combined hierarchical-sequential correlation method using edge images.

ETL-0249

AD-A095 169

Steller, David  
Adams, Jeffrey W.  
Muir, William

**RADAR, THERMAL INFRARED, AND  
PANCHROMATIC IMAGE COLLECTION AND  
ANALYSIS Multi-Source Image Analysis  
December 1980**

Earth Science Consulting and Technology Corp.

DAAK70-78-C-0180

**Supplementary Notes:** Addendum to ETL-0208, "Multi-Source Image Analysis."  
AD-A086 332, dtd DEC. 79.

**Keywords:** Image Interpretation, Panchromatic, Radar, Remote Sensing, Thermal Infrared.

The addendum to the Multi-Source Image Analysis contract consists of a reference set of simultaneously collected remote sensor data designed to evaluate terrain features. Airborne radar, thermal infrared and panchromatic imagery was collected by the Oregon Army National Guard at the Corvallis, Oregon, test site on 13 and 19 August 1980. Ground teams collected radiant and air temperatures, ground site photographs and soil samples from three traverses through the test area.

ETL-0250

AD-A100 037

Crombie, Michael A.

**AN EVALUATION OF REGISTERING IMAGE  
GRADIENTS WHEN MATCHING INFRARED  
IMAGERY TO PANCHROMATIC IMAGERY**  
January 1981

**Keywords:** Base-Height Ratio, Correlation, Digital Pictures, Image Gradient, IR Imagery, Panchromatic Imagery, Signal Power.

A method for calculating corresponding points between infrared imagery and panchromatic imagery using the image gradients and two vector functions is evaluated. The results of the study demonstrate that the method is not satisfactory for mapping.

ETL-0251

AD-A100 036

**NORTH-SEEKING GYROCOMPASS  
FINAL TECHNICAL REPORT**  
October 1980

Sperry Gyroscope

DAAK70-78-C-0210

**Keywords:** North-Finding Module, North-Seeking Gyrocompass.

This report describes the north-seeking gyrocompass delivered for evaluation of the M113 armored vehicle. The system consists of a north-finding module attached to a vehicle mounted gimbal set and a separate control panel/battery charger. The gyrocompass supplies azimuth to an accuracy of 2 mils rms approximately 2 minutes after turn-on.

ETL-0252

AD-B057 339L

Huddle, J.R.  
Buchler, R.J.  
Brockstein, A.J.  
Bose, S.C.

**A STUDY TO OPTIMIZE PERFORMANCE  
OF THE RAPID GEODETIC SURVEY SYSTEM  
INTERIM TECHNICAL REPORT  
January 1981**

Litton Guidance and Control Systems

DAAK70-80-C-0242

**Keywords:** Gravity Disturbance Vector Mapping, Inertial Instrument Stability Testing, Inertial Surveying, Simulation of Inertial Survey Systems, Two-Dimensional Smoothing.

The first interim study report presents preliminary results of a study of the USAETL Rapid Geodetic Survey System as to its capability for meeting performance goals of mapping the gravity disturbance vector to 0.3 sec (RMS) for the deflection components and 0.5 milligal (RMS) for the gravity anomaly on an interim basis with 0.1 sec (RMS) for the deflection components and 0.2 milligal (RMS) for the gravity anomaly as an ultimate goal.

The study determines the error characteristics of the existing system by laboratory testing and introduces these results into a simulation program to validate performance of the existing system. The effects of adjustment of specified system error parameters can then be assessed on an individual basis along with the impact of *real-time software mechanization changes*. *Performance improvements are also obtainable* with changes in operational procedures and also by an off-line Regional Adjustment Program (RAP) which combines the results of numerous traverses through an area in an optimal fashion.

A number of changes to the system hardware to allow the performance goals to be obtained are identified herein. Simulation results validating performance of the current equipment along with necessary hardware and software changes to obtain the interim and ultimate performance goals will be documented in the second interim and final study report.

**ETL-0253**

**AD-B062 053L**

Adams, G.  
Borree, T.

**GRAVITY STUDY PROGRAM**  
**February 1981**

Honeywell, Inc.

**DAAK70-80-C-0138**

**Keywords:** Deflections of the Vertical, Gravity Anomaly, Gravity Measurement Improvement Study, Inertial Positioning Systems 2 (IPS-2).

This document is an interim report of a study to determine the changes required in the IPS-2 to provide an improved precision gravity survey capability. An interim development program has been recommended to correct the error sources identified to date. Presently identified changes and those to be identified at the completion of this study will affect the Velocity Measurement Unit, on-line software, operational procedures and/or post mission data processing and should result in a survey system which will meet or exceed the 0.3 arc-second deflections and 0.5 milligals anomaly and permit development of the long term goals.

**ETL-0254**

**AD-A107 048**

Wright, Janet S.  
Vogel, Theodore C.  
Pearson, Alexander R.  
Messmore, Jeffrey A.

**TERRAIN ANALYSIS PROCEDURAL**  
**GUIDE FOR SOIL. Report No. 6 in the**  
**ETL Series on Guides for Army Terrain Analysts**  
**February 1981**

**Keywords:** Factor Mapping, Military Geographic Information, Terrain Analysis, Thematic Mapping, Soil.

This report is one in a series of terrain analysis procedural guides being developed in support of the Topographic Support System (TSS). It was written specifically for a U.S. Army terrain analyst and presents the step-by-step methods needed for extracting, reducing, and recording soil information on a factor overlay and supporting data table.



**ETL-0255**

**AD-A099 803**

**Barrón, Rosalinda P.**

**BIBLIOGRAPHY OF IN-HOUSE AND  
CONTRACT REPORTS, SUPPLEMENT 9  
February 1981**

This is supplement 9 to the report titled "Bibliography of In-House and Contract Reports," (AD-877 653L), (Supplement 1, AD-890 066L), (Supplement 2, AD-905 548L), (Supplement 3, AD-B005 275L), (Supplement 4, AD-B010 642L), (Supplement 5, AD-B019 966L), (Supplement 6, AD-A055 468), (Supplement 7, AD-A068 744), (Supplement 8, AD-A084 111). It is a continuing bibliography of reports prepared by and for the U.S. Army Engineer Topographic Laboratories (USAETL), Fort Belvoir, Virginia. This bibliography includes reports published from 1 January 1980 through 31 December 1980.

**ETL-0256**

**AD-A110 322**

**Moyer, Alan L.**

**ACOUSTO-OPTIC TECHNOLOGY FOR  
TOPOGRAPHIC FEATURE EXTRACTION  
AND IMAGE ANALYSIS  
March 1981**

**Deft Laboratories, Inc.**

**DAAK70-79-C-0160**

**Keywords:** Acousto-Optics, Algorithms, Feature Extraction, Image Processing.

This report contains all findings of the acousto-optic technology study for feature extraction conducted by Deft Laboratories Inc. for the U.S. Army Engineer Topographic Laboratories. The objective of this program was to develop, analyze and evaluate theoretical concepts and strategies for topographic feature extraction and image analysis using acousto-optic (A-O) technology.

A conclusion of this study was that A-O devices are potentially capable of implementing the feature extraction prefilter function very efficiently. Since the prefilter is the most computational intensive portion of the feature extraction process, this is a significant result. The best application of A-O devices is in the implementation of transform-based prefilter algorithms. Under this contract transform-based algorithms were identified and developed which are invariant to feature translation, rotation and scale. This invariance is highly desirable since it reduces the number of distinct feature signatures which must be processed by the decision processor.

Some preliminary experiments were conducted using the Fourier-based algorithms, test images and A-O device which was a Deft sensor. This combination of algorithms and sensor was able to distinguish between three test patterns which were presented in arbitrary orientation and scale. The success rate was 80 percent. In spite of these promising results, present Deft sensors are not capable of distinguishing realistic features in aerial photographs. New Deft sensors, presently under development, are described which will significantly improve the capability of this sensor in feature extraction applications.

ETL-0257

AD-A100 035

Grosso, P.F.  
Tarnowski, A.A.

**A CARTOGRAPHIC ELECTRON BEAM  
SCANNER DESIGN STUDY  
April 1981**

Image Graphics, Inc.

DAAK70-79-C-0132

**Keywords:** Digitize, Electron Beam Scanning, Scanner, Scintillator.

The feasibility of adding a scanning/readout capability to Cartographic Electron Beam Recorder System was successfully demonstrated. An electron beam scanning mode of operation would allow cartographic line and gray shade data recorded on film to be rapidly digitized using a high resolution scanning electron beam. Further engineering programs are recommended to develop this capability.

Stockman, George C.  
Lambird, Barbara A.  
Lavine, David  
Kanal, Laveen N.

**KNOWLEDGE-BASED IMAGE ANALYSIS**  
April 1981

L.N.K. Corporation

DAAK70-77-C-0110

**Keywords:** Feature Extraction, Image Analysis, Image Matching, Map-Guided Cartography, Pattern Recognition, Region Classification, Registration, Verification.

The work reported was directed toward employing *a priori* knowledge in the automatic analysis of aerial imagery. Major objectives of the research were directed toward (1) map-guided registration, (2) verification of geographic data bases extracted from imagery, (3) enrichment of geographic data bases, and (4) automatic terrain feature extraction using multiple sources of knowledge and multi-level decision making. The key component in all of the work was the matching of existing iconic structure in a geographic data base (GDB) with detected image structure.

By using iconic knowledge, the image interpretation paradigm becomes a three step process. First, some primitive features of the imagery must be recognized without any area-specific knowledge. Second, the imagery is aligned or registered with the knowledge base by drawing correspondences between the image features and their iconic analogues in the GDB. The matching is formalized by derivation of a transformation which maps points  $(x, y)$  of the image to points  $(u, v)$  in GDB coordinates. The final step of the process is the analysis of those parts of the image which were not successfully interpreted in steps 1 and 2. This implies a top-down search for image structures which correspond to features in the GDB.

Section 2 of the report treats primitive extraction. The emphasis is currently on lineal, point, and region features only. A method for automatically inferring a rotation and translation transforming image to map is given in Section 3. Classification of registered regions is discussed in Section 4. Verification of lineal GDB features in gray-scale imagery is introduced in Section 5.

ETL-0259

AD-A101 422

Taylor, Cyrus C.

**SHADED RELIEF IMAGES FOR  
CARTOGRAPHIC APPLICATIONS**  
April 1981

**Keywords:** Atmospheric Haze, Gray-Shade Image, Image Formation, Light Scattering, Orthonormal Projection, Perspective Projection, Photometry, Polynomial Data Base, Relief Contours, Shaded Relief, Variable Sun Angle.

The computer generation of shaded relief images for cartographic applications is analyzed. The geometric theory of image formation is presented in some detail, and is used to motivate the discussion of the image simulation algorithms developed at the U.S. Army Engineer Topographic Laboratories (ETL). Several algorithms devised to address specific cartographic problems, such as variable sun angle, haze simulation, and relief contour algorithms, are also discussed. The successful implementation of these algorithms is described. Appendixes summarizing details of the theory are included, as are a Software User's Guide, sample images, and listings of the ETL software.

ETL-0260

AD-A103 806

Strikwerda, Thomas E.  
Junkins, John L.

**STAR PATTERN RECOGNITION AND  
SPACECRAFT ATTITUDE DETERMINATION**  
May 1981

Virginia Polytechnic Institute & State University

DAAK70-78-C-0038

**Keywords:** Attitude, Navigation, Orientation, Pattern Recognition, Spacecraft, Stellar Camera.

A method for real-time on-board spacecraft attitude determination is presented. The method is suitable for processing CCD or CID stellar camera and rate gyro output to determine orientation to better than five arc seconds. The system is self-calibrating; uncertain parameters such as interlock angles and gyro biases can be included in the estimation algorithms. The system is implemented in a micro-computer system which conclusively establishes that the system is compatible with on-board computation constraints.

ETL-0261

AD-A102 893

Ehlen, Judy

**THE IDENTIFICATION OF ROCK TYPES IN  
AN ARID REGION BY AIR PHOTO PATTERNS  
June 1981**

**Keywords:** Air Photo Interpretation, Arid Region, Rock Type Identification.

Air photo pattern criteria to identify rock types in an arid environment were evaluated for their usefulness and accuracy by stereo air photo analysis and field verification. The criteria came from published literature and from unpublished in-house research. In general, the unpublished criteria proved the most useful. New criteria to identify granitic rocks were successfully tested, and criteria for quartzite and andesitic rocks were identified. In addition, a basis was laid to develop criteria to identify metamorphic rocks by composition on aerial photography.

Sixteen lithologic units were identified and mapped on 1:100,000 scale stereoscopic panchromatic aerial photography. Lithologic predictions were based on detailed analyses of the photo pattern elements of landform, drainage, photo tone, and photo texture. Limited field checking showed that the lithologic predictions were generally correct. In addition, the boundaries of the lithologic units, not verified in the field, but determined from detailed photo analysis, compared favorably with boundaries shown on published geologic maps.

ETL-0262

AD-B060 540L

Adams, G.  
Borree, T.  
Hadfield, M.

**GRAVITY STUDY PROGRAM  
June 1981**

Honeywell, Inc.

DAAK70-80-C-0138

**Keywords:** Deflections of the Vertical, Gravity Anomaly, Gravity Measurement Improvement Study, Inertial Positioning Systems 2 (IPS-2).

This document is a final report of a study to determine the changes required in the IPS-2 to provide an improved precision gravity survey capability. An interim development program has been recommended to reduce the error sources identified to date. Identified changes during this study will affect the Velocity Measurement Unit, on-line software, operational procedures and/or post mission data processing and should result in a survey system which will meet or exceed the 0.3 arc-second deflections and 0.5 milligal anomaly and permit subsequent development of the long term goals.

ETL-0263

AD-A104 208

**SYNTHESIS GUIDE FOR LINES OF  
COMMUNICATION (Report No. 7 in the ETL  
Series on Guides for Army Terrain Analysts)  
June 1981**

Tazelaar, James

**Keywords:** Data Elements, Data Fields, Factor Overlays, Military Geographic Information, Terrain Analysis.

This report provides methods and procedures employed by U.S. Army Terrain Analysts to synthesize an LOC overlay from previously formatted military geographic information (MGI) thematic graphic data base (TGDB). Specific terrain factor overlays, such as Roads and Related Structures, Railroads, Airfields, etc. are taken one at a time and LOC-relevant data are traced onto a single frosted mylar overlay that, redrafted, becomes the final LOC document. By combining specific terrain factor overlay data from MGI TGDB, the analyst produces a topographic product suitable for expedient reproduction by Army topographic field elements.

**ETL-0265**

**AD-A100 498**

Grosso, P.F.  
Tarnowski, A.A.

**RECORDING AND SCANNING ADVANCES  
IN CARTOGRAPHIC EBR SYSTEMS  
June 1981**

Image Graphics, Inc.

**DAAK70-77-C-0211**

**Keywords:** Automated Cartography, Cartographic EBR, Computer Graphics, Electron Beam Recorder (EBR), Micrographic EBR, Recorder, Scanner.

The experimental model cartographic EBR System developed for USAETL in 1977 was modified to include a number of advance hardware and software features: A Symbol/Vector Generator for plotting cartographic and names data; a Raster Scan Translator for recording continuous tone images; a scanning capability; a multiformal and size control; and other improvements.

**ETL-0266**

**AD-B062 490L**

Tobin, Ephriam

**ELECTROPHOTOGRAPHIC IMAGING  
MATERIALS EVALUATION  
June 1981**

Perkin-Elmer Corporation

**DAAK70-80-C-0180**

**Keywords:** Electrophotography, Electro-Static, Fusing, Image Quality, Photo-conductive Film, Sensitometry, Surface Charge, Toner.

The recording capability of James River Graphics P5-003 and Eastman Kodak SO-101 were assessed after they were processed in a number of different toners. The evaluation covered the sensitometric performance and image quality of the materials in relation to their charge acceptance, dark decay, latent image-decay, continuous tone-sensitometry, resolution, granularity, edge-acutance, and digital recording capabilities. The results are discussed for each manufacturer's product and for the comparison of the products.

ETL-0267

AD-A109 144

Baldini, Angel A.

**ERROR STATISTICS FOR ASTROGEODETTIC  
POSITIONS FOR AN RGSS TEST COURSE  
July 1981**

**Keywords:** Conventional Astrogeodetic Methods, Deflections of the Vertical, Error Adjustments, Inertial Survey System.

In the experimental mobile inertial survey system, geodetic parameters are measured relative to an origin point. Certain errors build up along the survey course. Typically, these errors are adjusted and distributed both during and after completing each mission. During testing, the adjusted derived data are compared with "known" data that are determined by conventional "classical" surveys. In its research, ETL requires a more accurate adjustment of errors obtained from conventional methods.

The approach to the problem involved evaluating and analyzing the various error sources in the conventional data recalculation of certain data by new methods and developing a new statistical error treatment that applies not only to the objectives of this in-house research, but to the general application of inertial geodetic systems.

In this report, a new statistical error procedure has been developed to improve astrogeodetic positions that are useful in ETL's core program of RGSS tests and in any future tests of inertial systems.

ETL-0268

AD-A110 538

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**EXPERIMENTAL ASSESSMENT OF IMPROVED  
SPATIAL RESOLUTION LANDSAT DATA  
September 1981**

Earth Satellite Corporation

DAAK70-80-C-0016

**Keywords:** Agricultural Patterns, Digital Image Processing, Lake and Stream Delineation, LANDSAT, Multispectral Scanner, Return Beam Vidicon, Roads and Bridges, SEASAT, Shoreline Mapping, Swamp and Marsh Delineation, Urban Area Delineation.



This report describes the possible uses of higher resolution (25 meter) space-derived images for delineating and measuring surface features of interest in the Corps of Engineers Civil Works Program. Following a discussion of imaging sensors and computer processing methods, test evaluations are described in which LANDSAT multispectral scanner data and SEASAT SAR data were interpreted for surface features. The comparative advantages of the two data sources are discussed, and the complementary nature of LANDSAT MSS and SEASAT SAR images is displayed in the image analyses. Image examples are included for both background discussion and test site evaluation.

ETL-0270

AD-A109 138

Hevenor, Richard A.

**SCATTERING FROM A VEGETATION  
LAYER WITH AN IRREGULAR  
VEGETATION SOIL BOUNDARY  
October 1981**

**Keywords:** Electromagnetic Waves, Vegetation Scattering.

A theoretical model is computed for the backscattering of electromagnetic waves from a layer of vegetation by using a first-order renormalization technique to determine volume scattering. The vegetation soil interface is assumed rough according to the tangent plane approximation and the scattering from this boundary is added incoherently to the volume scattering result. The mean wave in the vegetation is obtained using a bilocal approximation of the Dyson's equation. A free space dyadic Green's function is used, along with a correlation function of the dielectric fluctuations that are exponential in form and that also possess different correlation lengths  $\ell_x$ ,  $\ell_y$ , and  $\ell_z$  in the x, y, and z directions. Effective propagation constants are obtained for both horizontal and vertical polarization. The scattered wave is solved for by using a two-dimensional Fourier transform technique, and the boundary conditions at either end of the vegetation layer are matched. The far field backscatter coefficients are computed for both horizontal and vertical polarizations. The mean and variance of the dielectric fluctuations are calculated with the aid of Peake's model for the dielectric constant of vegetation. The theory is matched to experimental data taken from a corn field. The resulting values for the correlation parameters are then used to monitor the growth pattern of the corn field over a period of time. Comparisons between the theoretical and experimental results over this time period are shown. The theory is also matched to experimental data from spring and fall deciduous trees.

ETL-0271

AD-A109 139

Rohde, Frederick W.

**A STUDY OF THE HUMAN VISUAL  
SYSTEM IN SUPPORT OF AUTOMATED  
FEATURE EXTRACTION  
October 1981**

**Keywords:** Artificial Intelligence, Contrast Vision, Human Visual System, Visual Feature, Visual Perception.

An in-depth study of the anatomy and architecture of the visual system was conducted. Signal processing along the visual pathway was analyzed. The functions of the major components of the visual systems were studied and the number of neurons determined. A comparison of the visual system with a computer was made. The concept of a feature extraction system was developed and discussed.

ETL-0272

AD-A109 145

Norvelle, F. Raye

**INTERACTIVE DIGITAL CORRELATION  
TECHNIQUES FOR AUTOMATIC COMPILATION  
OF ELEVATION DATA  
October 1981**

**Keywords:** Anaglyphic Stereo Display on Video Equipment, Digital Correlation, Interactive, Stereo Image Matching.

A program using digital correlation techniques has been implemented on the Digital Image Analysis Laboratory (DIAL) to extract elevation data automatically from stereoscopic pairs of digital images. The DIAL enables the operator to view on a display unit the stereoscopic model and the computed match-point coordinates in 3-D using anaglyphic techniques. The match points are presented as 3-D profiles superimposed over the 3-D terrain model, and consequently, the operator can observe the compilation process, detect errors as soon as they occur, and interact with the process to prevent the accumulation of error or to tune the parameters as conditions warrant. The program is described in terms of the hardware, the algorithm, the operating procedures, and the examples of compiled areas.

ETL-0273

AD-B061 479L

Lambird, Barbara A.  
Lavine, David  
Kanal, Laveen N.

**INTERACTIVE KNOWLEDGE-BASED  
CARTOGRAPHIC FEATURE EXTRACTION**  
October 1981

L.N.K. Corporation

DACA76-80-C-0008

**Keywords:** Cartographic Feature Extraction. Expert Systems, Knowledge-Based Cartography.

The report presents the results of a technical study on a cartographic feature extraction system for the Digital Image Analysis Laboratory at the U.S. Army Engineer Topographic Laboratories. Included is a survey of the state of the art in cartographic feature detection and a design for a cartographic feature extraction system. The system has two parts - an image processing system that provides tentative segmentation and classification of the image.

The second part of the system is a rule-based production expert system that uses expert cartographic knowledge to detect the cartographic features based on the results of the first system. The systems are designed to be modular so that they are easy to implement, modify, update, and use.

ETL-0276

AD-B061 822L

**THE DESIGN, MODIFICATION, FABRICATION AND  
TEST OF A PROTOTYPE MINIATURIZED NORTH  
REFERENCE UNIT (MINRU)**  
March 1979

Litton Guidance & Control System

DAAK70-77-C-0198

**Keywords:** Direction Finding, Position (Location).

This report summarizes the results of analysis, design and prototype development of a Miniature North Reference Unit (MINRU). Included among the efforts described are the hardware fabrication and acceptance testing of the unit. As the program progressed, hardware and software modifications were incorporated to satisfy the prescribed equipment error budgets and, ultimately, to achieve the performance within the constraints of the contract.

ETL-0278

AD-A110 247

Lavine, David  
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**ANALYSIS AND SIMULATION OF  
DISCRETE DIGITAL IMAGE MATCHING**  
November 1981

L.N.K. Corporation

DACA76-81-C-0004

**Keywords:** Clustering, Correlation, Digital Image Registration, Feature Extraction, Image Matching, Point Features, Simulation.

This report evaluates procedures for the approximate registration of digital images to maps and other images. It emphasizes point features and vectors derived from point features for image registration. Labeling and other means of adding definiteness to feature identification are promoted as ways to speed up registration. Clustering algorithms, distribution and type of features, hierarchical matching techniques, and other procedures are investigated with scene and map simulations.

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